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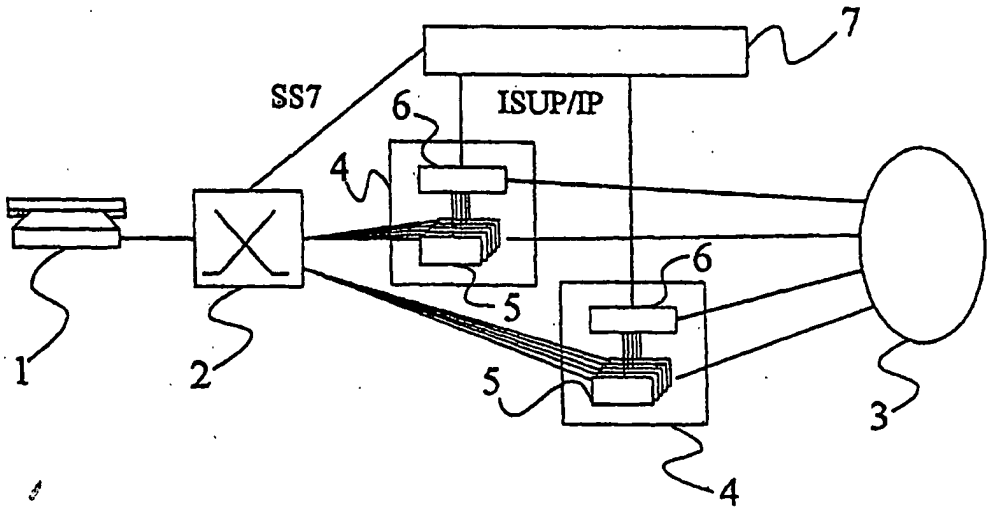

(57) Abstract

A method of transferring signalling messages between an Internet Service Provider (ISP) (4) and an exchange (2) of a telecommunications network for the purpose of allocating and controlling circuit switched communication channels between the exchange (2) and the ISP (4). The method comprising routing the signalling messages via an SS7/IP gateway which provides for conversion of messages between an SS7 protocol used in the telecommunications network and an IP based protocol used in the network which connects the SS7/IP gateway 7 to the ISP 4. For each message received at the SS7/IP gateway 7 from the ISP 4, the SS7/IP gateway 7 confirms the right of that ISP 4 to control a circuit switched communication channel identified in the message.

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SECURITY IN TELECOMMUNICATIONS NETWORK GATEWAYS

Field of the Invention

The present invention relates to security in telecommunications networks and in particular to a method and apparatus for preventing one Internet Access Provider from interfering with telephone circuits allocated to another Internet Access Provider by a common telecommunications network operator.

Background to the Invention

At the present time, in order to access the Internet, a user typically has to make a connection (possibly via a modem) to a local telephone exchange of a telecom operator. The exchange then sets-up a circuit switched connection between the user and an input device of an Internet Service Provider (ISP) identified by a telephone number (B-number) dialled by the user. In some cases, the connection may be routed via one or more intermediate exchanges. In either case, the telephone network treats the connection as it would any normal telephone-to-telephone connection, i.e. it is not aware that the connection serves as an Internet access connection.

The European Telecommunications Standards Institute (ETSI) has recently established a project under the acronym TIPHON (Telecommunications and Internet Protocol Harmonisation Over Networks) to support the market for voice communication and related voiceband communication (e.g. facsimile) between users connected to both circuit switched networks and IP based networks. As part of TIPHON, it has been proposed to more closely integrate the ISPs into the telecommunications networks and in particular to provide for the exchange of signalling

information between ISPs and the exchanges of telecommunications networks, for the purpose of setting up and managing the circuit switched connections between exchanges and the input devices of the ISPs.

The current TIPHON proposal provides for a signalling gateway which acts as the interface between the signalling network of the telecom operator and the ISP. It is expected that the signalling network of the telecom operator will typically be a Signalling System No.7 (SS7) network which carries messages of the ISDN User Part (ISUP) protocol, whilst communications between the signalling gateway and the ISP are expected to be carried over an IP network. One of the roles of the signalling gateway is therefore to seamlessly relay ISUP messages from the Time Division Multiple Access (TDMA) SS7 network to the ISP over the packet switched IP network, and *vice versa*. The signalling gateway is generally referred to as an SS7/IP gateway.

It is likely that the SS7/IP gateways will be under the control of the telecom network operator, and that a single gateway may provide a signalling interface to the telecom network for a plurality of independently operated ISPs.

Summary of the Present Invention

The inventors of the present invention have discovered that under the current TIPHON proposals it is possible for an ISP connected to an SS7/IP gateway to interfere with the control of another ISP, and in particular with circuits allocated to that other ISP, connected to the same SS7/IP gateway.

It is therefore an object of the present invention to overcome or at least mitigate this problem of fraudulent (or accidental) cross-ISP interference.

This and other objects are achieved by including functionality in the SS7/IP gateway for authenticating signalling messages received from ISPs connected thereto on the basis of the message content and the origins of the messages.

According to a first aspect of the present invention there is provided a method of transferring signalling messages between an Internet Service Provider (ISP) and an exchange of a telecommunications network for the purpose of allocating and controlling circuit switched communication channels between the exchange and the ISP, the method comprising:

routing said signalling messages via a signalling gateway which provides for conversion of messages between a first transmission protocol used in the telecommunications network and a second transmission protocol used in the network which connects the signalling gateway to the ISP; and

for each message received at the signalling gateway from the ISP, confirming the right of that ISP to control a circuit switched communication channel identified in the message.

By authenticating signalling messages received at the signalling gateway from the ISP, the signalling gateway is able to prevent fraudulent messages from being passed from the ISP to the exchange which might otherwise interfere with those circuits allocated by the exchange to another ISP.

Preferably, a record is maintained at the signalling gateway, of the circuit switched communication channels allocated to each ISP coupled to the signalling gateway.

Preferably, the telecommunication network comprises a Signalling System No.7 (SS7) based signalling network which is interfaced to the ISP via the signalling gateway. More preferably, the network coupling the signalling gateway to the ISP is an IP based network, such that the signalling gateway provides a conversion between at least the Message Transfer Part protocols (i.e. said first transmission protocol) of the SS7 network and the IP based protocols. This arrangement allows ISUP messages to be transferred, transparently, between the exchange and the ISP.

In certain embodiments of the invention, the ISP from which a signalling message originates is identified at the signalling gateway by virtue of the source IP address associated with the IP datagram in which the message is delivered to the gateway. Typically, each ISP coupled to the signalling gateway is allocated a unique IP address. The signalling gateway maintains a record of those circuits which are allocated to a given ISP/IP address.

In other embodiments of the invention, each of the ISPs connected to a given signalling gateway is allocated a unique Point Code in the signalling network of the telecommunications network, Point Codes being included in the header of a signalling message to indicate the destination and source of the message. The signalling gateway screens messages received from an ISP to confirm that the source Point Codes contained therein correspond to the actual ISPs from which they originated. Again, the originating ISP for a message may be identified on

the basis of the source IP address of the message containing datagram.

In other embodiments of the invention, the ISP from which a signalling message originates is identified by virtue of the input port/device of the signalling gateway at which the message. Thus input port/device identity may be used as an alternative to the source ISP IP address.

According to a second aspect of the present invention there is provided apparatus for transferring signalling messages between an Internet Service Provider (ISP) and an exchange of a telecommunications network for the purpose of allocating and controlling circuit switched communication channels between the exchange and the ISP, the apparatus comprising a signalling gateway coupled between a signalling network of a telecommunications network and a network connected to an Internet Service Provider (ISP) and arranged to:

convert messages between a first transmission protocol used in the telecommunications network and a second transmission protocol used in the network which connects the signalling gateway to the ISP; and

for each message received at the signalling gateway from the ISP, to confirm the right of that ISP to control a circuit switched communication channel identified in the message.

Brief Description of the Drawings

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 shows a signalling gateway coupling a signalling network of a telecommunications network to a number of ISPs;

Figure 2 illustrates schematically the protocol stacks implemented at the signalling gateway of Figure 1; and

Figure 3 is a flow diagram illustrating the method of operation of the signalling gateway of the network of Figure 1.

Detailed Description of Certain Embodiments

In Figure 1 there is illustrated a subscriber telephone 1 connected to a local access exchange 2 of a telephone network. This network is assumed to be a conventional network employing PSTN, ISDN, or certain other known communication protocols. Within the network, circuit switched channels over which voice or data may be transmitted are set up and controlled using a Signalling System No.7 based signalling network (e.g. CCITT No.7). More particularly, inter-exchange signalling messages carried by the SS7 network conform to the ISDN User Part (ISUP) protocol.

The present example is concerned with the setting-up and control of a voice communication channel between the telephone network subscriber terminal 1 and a remote terminal (not shown in Figure 1) coupled to the Internet 3. The remote terminal may be for example a multi-media PC connected via a modem and a local access network to the Internet 3, or it may be a telephone network subscriber telephone similar to the telephone 1. In either case, voice data is communicated between the two terminals/telephones over the Internet 3.

A number of ISPs 4 are each allocated a large number of circuit switched channels by the access exchange 2, and

each of these channels has an identification number (CIC) unique to the exchange 2. In order to access the Internet, it is necessary to establish a connection over one of the allocated channels between the subscriber telephone 1 and an Internet interface device 5 (via the access exchange 2) provided by one of the ISPs 4.

The interface device 5 is known in the art as a "Media Gateway" and is arranged to convert voice information received from the telephone 1 into a form suitable for transmission over the Internet (involving for example transcoding, formatting, etc) and to perform the reverse transformation for data received over the Internet and destined for the telephone 1. It is noted that the Media Gateway 5 may communicate with a remote Media Gateway, or with a remote IP terminal, using the ITU multi-media protocol H.323 although this will not be considered here in further detail.

Each ISP 4 has a "Media Controller" 6 which is analogous to a conventional telecommunications network switch, i.e. it is responsible for the general management of Media Gateway resources and in particular for allocating Media Gateways to subscribers (or rather to circuits originating at the access exchange 2).

The Media Controller 6 is arranged to exchange signalling information with a signalling gateway 7, referred to hereinafter as an SS7/IP gateway, which is under the control of the telecommunications network operator and can thus be considered secure from the point of view of the operator. The SS7/IP gateway 7 is connected to the SS7 network and as such is typically allocated a unique Point Code within the visibility area of the SS7 network, which Code provides a destination (and source) address for messages within the network. The physical connection between the Media Controllers 6

and the SS7/IP gateway 7 is provided by an IP network which may be the Internet but which is more probably an intranet having no public access.

Figure 2 illustrates the communication protocol layers implemented at the SS7/IP gateway 7 in order to allow ISUP messages carried by the SS7 signalling network to be relayed over the IP network to the Media Controllers 6, and *vice versa*. ISUP messages received at the SS7/IP gateway 7 from the access exchange 2 over the SS7 network are processed through a Message Transfer Part (MTP) layer 8 (see "Understanding Telecommunications", vols. 1 & 2, Studentlitteratur, Lund, Sweden (ISBN 91-44-00214-9)) before being passed to a processing and control part 9. Messages are relayed through this part 9 before being processed by a TCP/IP part 10 to provide IP datagrams suitable for transmission over the IP network to the Media Controllers 6. Messages received at the SS7/IP gateway 7 over the IP network are processed in the reverse direction, with the processing and control part 9 performing an additional message authentication operation as will now be described.

For the purpose of routing datagrams over the IP network between the SS7/gateway 7 and the Media Controllers 6 of the various ISPs 4, each Media Controller 6 is allocated an IP address (unique in that IP network). The IP address allocated to a Media Controller 6 is incorporated into all datagrams sent by that controller 6 to the SS7/IP gateway 7 and enables the SS7/IP gateway 7 to confirm the source of a received packet.

When a signalling message is received by the SS7/IP gateway 7, the processing and control part 9 identifies the IP address associated with the message. The gateway 7 maintains a record of the IP addresses allocated to the various Media Controllers 6 as well as a record of

the circuits (CICs) allocated to each ISP. Each signalling message contains in its header part the CIC to which the message relates. The processing and control part 9 confirms that the originating ISP 4, identified from the source IP address, is allocated the CIC to which the signalling message relates. If the result is positive, the message is passed to the MTP 8 for relaying to the access exchange 2. If the result is negative, i.e. the signalling message relates to a CIC not allocated to the originating ISP 4, then the message is not relayed further and is discarded. In this event, an error message may be returned to the originating ISP 4 and also possibly to the access exchange 2.

Figure 3 is a flow chart illustrating the message authentication and relay steps performed at the SS7/IP gateway 7 upon receipt of a signalling message from an ISP 4.

It will be appreciated that modifications may be made to the above described embodiment without departing from the scope of the present invention. For example, each Media Controller 6 may be allocated a Point Code in the SS7 network of the telecommunications network. Thus, a Media Controller 6 may be made the destination node for an SS7 message rather than the SS7/IP gateway (although signalling messages are still routed through the SS7/IP gateway). As the Point Code is included in the header of an ISUP message, the SS7/IP gateway 7 may authorise a received signalling message by matching the Point code included in the message header with the source IP address.

Whilst the embodiment described above includes only a single exchange 2 to which the subscriber telephone 1, the SS7/IP gateway 7, and the ISPs 4 are all directly connected, it will be appreciated that this need not be

the case. Indeed, a more likely scenario involves a number of transit exchanges through which signalling data and circuit switched channels are routed. It will also be appreciated that the present invention is not limited to voice communications and is also applicable to general data communications.

The above description has also been concerned with the use of ISPs to connect subscribers to the Internet. The present invention may also be employed in connection with ISPs which connect subscribers to one or more closed intranets.

Claims

1. A method of transferring signalling messages between an Internet Service Provider (ISP) and an exchange of a telecommunications network for the purpose of allocating and controlling circuit switched communication channels between the exchange and the ISP, the method comprising:

routing said signalling messages via a signalling gateway which provides for conversion of messages between a first transmission protocol used in the telecommunications network and a second transmission protocol used in the network which connects the signalling gateway to the ISP; and

for each message received at the signalling gateway from the ISP, confirming the right of that ISP to control a circuit switched communication channel identified in the message.

2. A method according to claim 1 and comprising maintaining a record at the signalling gateway of the circuit switched communication channels allocated to each ISP coupled to the signalling gateway.

3. A method according to claim 1 or 2, wherein the telecommunication network comprises a Signalling System No.7 (SS7) based signalling network which is interfaced to the ISP via the signalling gateway.

4. A method according to any one of the preceding claims, wherein the network coupling the signalling gateway to the ISP is an IP based network.

5. A method according to claim 4 when appended to claim 3, wherein the signalling gateway provides a conversion between at least the Message Transfer Part protocols of the SS7 network and the IP based protocols

enabling ISUP messages to be transferred, transparently, between the exchange and the ISP.

6. A method according to claim 4 or 5, wherein the ISP from which a signalling message originates is identified at the signalling gateway by virtue of the source IP address associated with the IP datagram in which the message is delivered to the gateway.

7. A method according to claim 3 or to any one of claims 4 to 6 when appended to claim 3, wherein each of the ISPs connected to a given signalling gateway is allocated a unique Point Code in the signalling network of the telecommunications network, Point Codes being included in the header of a signalling message to indicate the destination and source of the message, and the signalling gateway screens messages received from an ISP to confirm that the source Point Codes contained therein correspond to the actual ISPs from which they originated.

8. A method according to claim 3 or to any one of claims 4 to 6 when appended to claim 3, wherein the ISP from which a signalling message originates is identified by virtue of the input port/device of the signalling gateway at which the message arrives.

9. Apparatus for transferring signalling messages between an Internet Service Provider (ISP) and an exchange of a telecommunications network for the purpose of allocating and controlling circuit switched communication channels between the exchange and the ISP, the apparatus comprising a signalling gateway coupled between a signalling network of a telecommunications network and a network connected to an Internet Service Provider (ISP) and arranged to:

convert messages between a first transmission protocol used in the telecommunications network and a second transmission protocol used in the network which connects the signalling gateway to the ISP; and

for each message received at the signalling gateway from the ISP, to confirm the right of that ISP to control a circuit switched communication channel identified in the message.

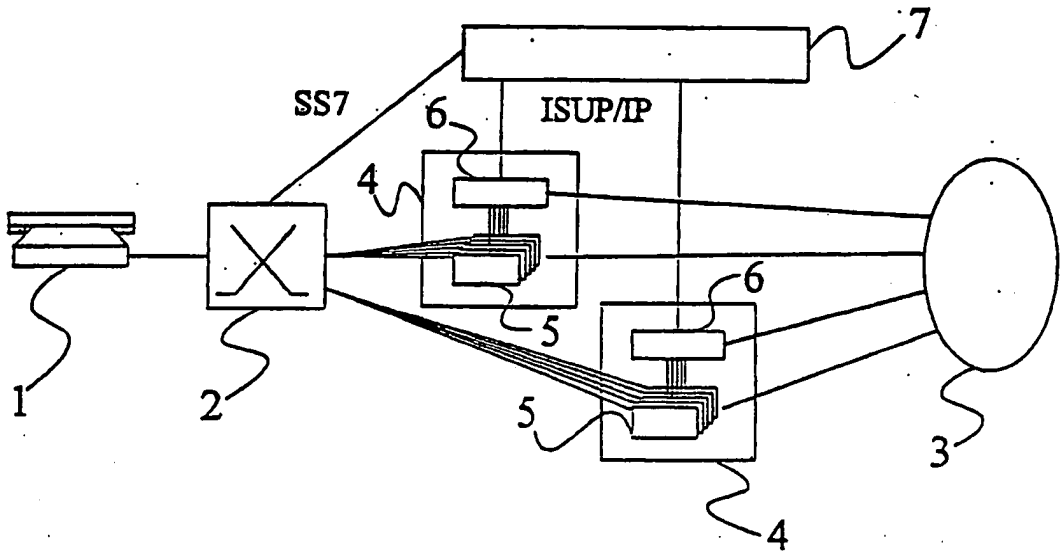

Figure 1

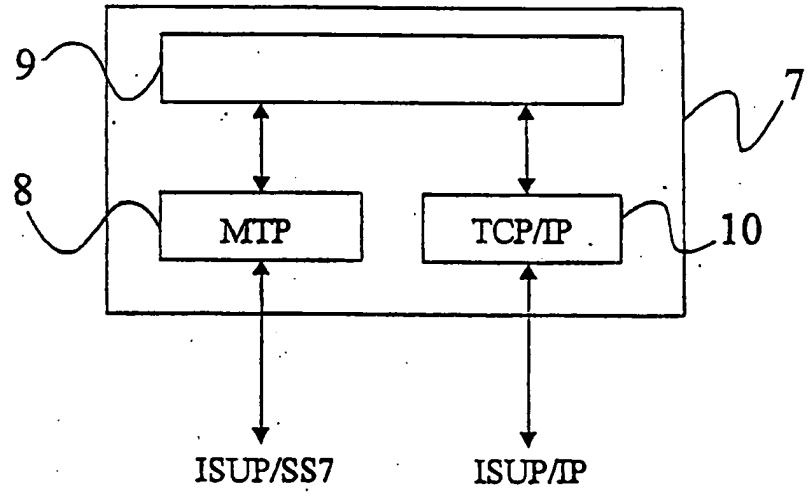

Figure 2

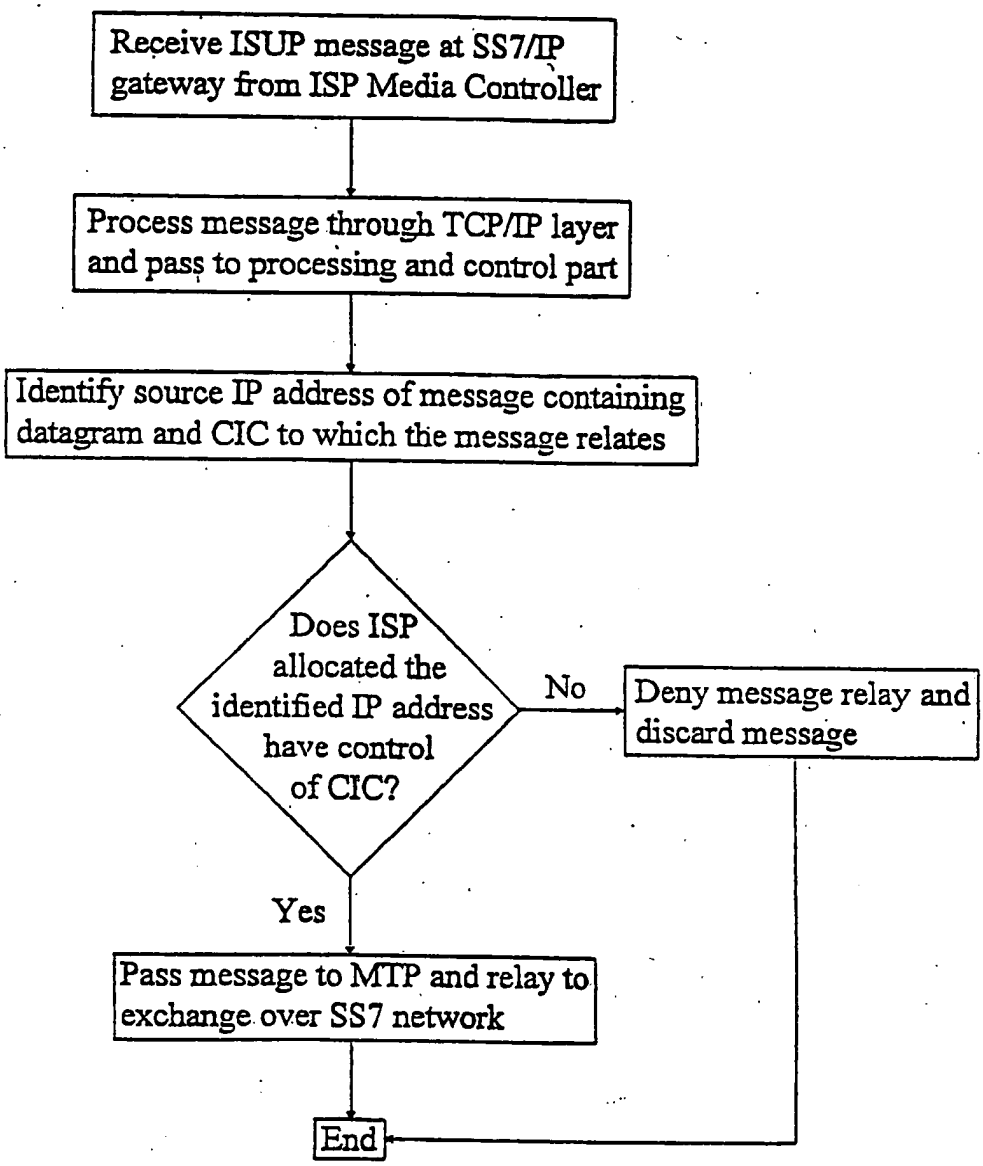
Receive ISUP message at SS7/IP gateway from ISP Media Controller
Process message through TCP/IP layer and pass to processing and control part
Identify source IP address of message containing datagram and CIC to which the message relates
Does ISP allocated the identified IP address have control of CIC?
No
Deny message relay and discard message
Yes
Pass message to MTP and relay to exchange over SS7 network
End

Figure 3

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q3/00 H04L12/66

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

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